

**WHAT IS CLAIMED IS:**

1. A process for preparing porous wiring interlayer insulating film having very low dielectric constant for a semiconductor comprising the steps of:

- 5           a) preparing a mixed complex of matrix resin and pore-forming organic molecules;
- b) coating the mixed complex on a substrate; and
- c) heating the mixed complex to remove the organic molecules, thereby forming pores inside the complex.

10       2. The process according to claim 1, wherein the matrix resin is selected from the group consisting of:

             organosilane of the Chemical Formula 1:  $R^1_m R^2_n SiX_{4-m-n}$  (where each of  $R^1$  and  $R^2$  which may be the same or different, is a non-hydrolysable group selected from hydrogen, alkyl, fluorine-containing alkyl or aryl group; X is a hydrolysable group selected from halide, alkoxy or acyloxy; and m and n are integers of from 0 to 3 satisfying  $0 \leq m+n \leq 3$ ) or a partially hydrolyzed condensate thereof;

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             organic bridged silane of the Chemical Formula 2:  $R^3_p Y_{3-p} Si-M-SiR^4_q Z_{3-q}$  (where each of  $R^3$  and  $R^4$  which may be the same or different, is a non-hydrolysable group selected from hydrogen, alkyl, fluorine-containing alkyl, alkenyl or aryl; each of Y and Z which may be the same or different, is a hydrolysable group selected from halide, alkoxy or acyloxy; M is alkylene or arylene group; and p and q are integers of from 0 to 2) or a cyclic oligomer with

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organic bridge unit (Si-M-Si) or a partially hydrolyzed condensate thereof.

and a mixture thereof

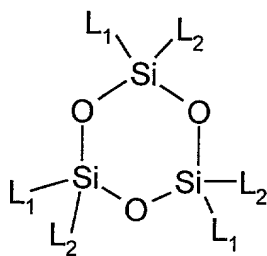
3. The process according to claim 2, wherein in the Chemical Formula 1,  $R^1$  and  $R^2$  are independently hydrogen, alkyl or phenyl and X is an alkoxy group.

5 4. The process according to claim 2, wherein the organosilane is selected from the group consisting of tetraalkoxysilane, monoalkyltrialkoxysilane, dialkyldialkoxysilane, trialkylmonoalkoxysilane, trialkoxysilane, monoalkyldialkoxysilane, and a mixture thereof.

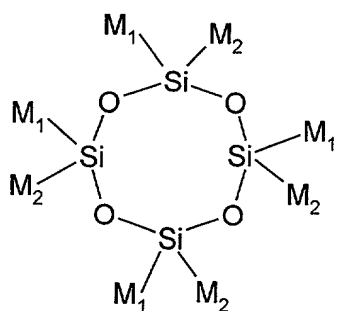
10 5. The process according to claim 2, wherein the organic bridged silane is synthesized by hydrosilylation reaction between a silane precursor containing a Si-H with a silane monomer containing aliphatic unsaturated carbon ( $-\text{CH}=\text{CH}_2$ ) in the presence of a catalyst.

15 6. The process according to claim 2, wherein the cyclic oligomer with organic bridged unit is synthesized by Grignard reaction of alkylhalide containing silane precursor.

7. The process according to claim 2, wherein the cyclic oligomer with organic bridge unit (Si-M-Si) is synthesized by the hydrosilylation reaction of a silane precursor containing a Si-H with an oligomer of ring structure (I) and/or (II):



(I)



(II)

wherein L<sub>1</sub> is alkenyl, L<sub>2</sub> is hydrogen, alkyl or aryl, M<sub>1</sub> is alkenyl, and M<sub>2</sub> is hydrogen, alkyl or aryl.

5      8. The process according to claim 1, wherein the pore-forming organic molecules are thermally decomposable.

9. The process according to claim 8, wherein the pore-forming organic molecules contain organic linkage groups that can be decomposed at 200 to 500°C.

10      10. The process according to claim 1, wherein the step a) comprises  
             partially hydrolyzing and condensing the matrix resin in an organic solvent after the addition of water and catalyst; and adding pore-forming material having thermally decomposable organic molecules to partially hydrolyzed condensate of the matrix resin; or

15              partially hydrolyzing and condensing the mixture of the matrix resin and pore-forming material having thermally decomposable organic molecules in an organic solvent after the addition of water and catalyst.

11. The process according to claim 10, wherein the molecular weight of the partially hydrolyzed condensate product of the matrix resin or a mixture of the

matrix resin and the pore-forming material is 500 to 1,000,000 as a weight average molecular weight.

12. The process according to claim 10, wherein the matrix resin is selected from the group consisting of:

5 organosilane of the Chemical Formula 1:  $R^1_m R^2_n SiX_{4-m-n}$  (where each of  $R^1$  and  $R^2$  which may be the same or different, is a non-hydrolysable group selected from hydrogen, alkyl, fluorine-containing alkyl or aryl group; X is a hydrolysable group selected from halide, alkoxy or acyloxy; and m and n are integers of from 0 to 3 satisfying  $0 \leq m+n \leq 3$ ) or a partially hydrolyzed

10 condensate thereof;

organic bridged silane of the Chemical Formula 2:  $R^3_p Y_{3-p} Si-M-SiR^4_q Z_{3-q}$  (where each of  $R^3$  and  $R^4$  which may be the same or different, is a non-hydrolysable group selected from hydrogen, alkyl, fluorine-containing alkyl, alkenyl or aryl; each of Y and Z which may be the same or different, is a hydrolysable group selected from halide, alkoxy or acyloxy; M is alkylene or arylene group; and p and q are integers of from 0 to 2) or a cyclic oligomer with organic bridge unit (Si-M-Si) or a partially hydrolyzed condensate thereof.

and a mixture thereof

13. The process according to claim 12, wherein the pore-forming material has at least one silyl functional groups at the end, so that it can be connected by covalent bonding with the matrix resin.

14. The process according to claim 1, wherein the step c) comprises:

heating the mixed complex to 150 to 350°C to effect curing without

significant thermolysis; and

further heating the cured complex to 350 to 600°C to effect thermolysis of the organic molecule part of the pore-forming material.

15. The process according to claim 1, wherein the step c) comprises heating  
5 the mixed complex to 350°C up to the lesser of the decomposition temperature of the matrix resin to simultaneously effect the curing of the complex and thermolysis of the organic molecule part of the pore-forming material.

16. An interlayer insulating film for metal wiring of a semiconductor, said film being prepared according to the process of claim 1.

10 17. An interlayer insulating film metal wiring of a semiconductor, said film being prepared according to the process of claim 2.

18. The interlayer insulating film according to claim 16, wherein the film has a dielectric constant of less than 3.3.

15 19. The interlayer insulating film according to claim 16, wherein the film has a median pore diameter less than 20 nm.

20. A semiconductor device comprising an interlayer insulating film for metal wiring, said film being prepared according to the process of claim 1.

21. A semiconductor device comprising an interlayer insulating film for metal wiring, said film being prepared according to the process of claim 2.